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Seeing and hearing the Riemann zeros

Two optical arrangements are envisaged in which the Riemann zeros would separate the side lobes of far-field diffraction patterns. A counting function for the primes can be rendered as a sound signal whose harmonies are the Riemann zeros. The individual primes cannot be discriminated in this music; conversely, if the prime singularities are detected as a series of clicks, the Riemann zeros correspond to frequencies too low to be heard. The sound generated by the Riemann zeta function itself is very different: a rising siren howl, which can be understood in detail from the Riemann-Siegel formula. The eigenangles of random matrices in the three standard circular ensembles are rendered as sounds in several different ways. The different fluctuation properties of these ensembles can be heard, and distinguished from the extreme cases of angles that are distributed uniformly round the unit circle, and those that are Poisson-distributed.